Micro Space Propulsion Program

MSP Industry Day

John D. Evans

September 21, 2007

MSP Goals / Milestones

Program Goal - similar to MEP

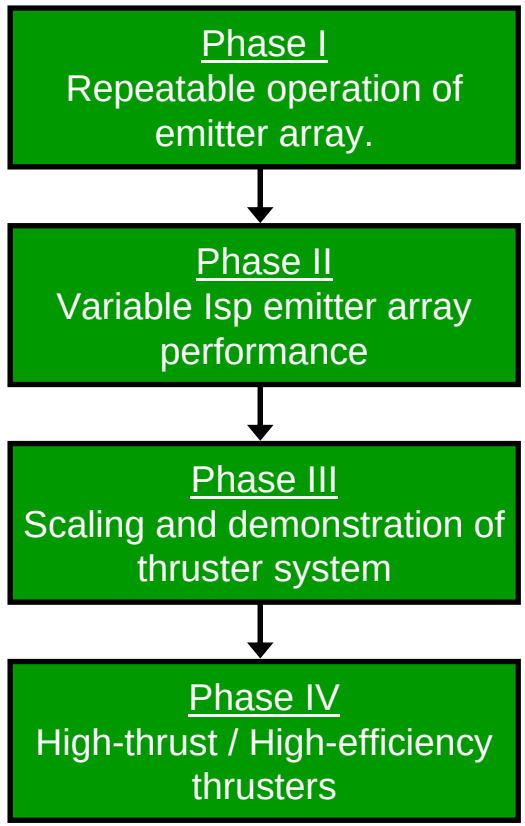
- Develop thruster technology that is scalable to provide on-the-fly control over specific impulse, enabling spacecraft that responsively meet changing national needs.

Then, what is new exactly?

- Change focus to Isp dynamic range.
- Focus on unit cell before scaling

Why a whole new BAA?

- Enable teams to re-scope the problem and form appropriate teams to address our new understanding of technical challenges.
- Bring in more project management expertise.
- Focus earlier on basic emitter performance.
- Refocus effort on Isp dynamic range.



MEP vs. MSP Structure

	Phase I	Phase II	Phase III	Phase IV
Challenge	**Unit Cell**		**System demonstration Scaling**	
	Operation	**Performance**		
Duration	TBD*	TBD*	TBD*	TBD*
Emitters	25+	25+	As needed	As needed
Power	N/A	N/A	1 W	100 W
Isp Range	Repeatable** emission >2000 s	500s – 10,000 s (on-the-fly adjustable)		
	Repeatable** emission 500 s			
Efficiency* **	10%	50%	70%	90%****

Error in BAA

* Phase duration to be determined by offerors, and will be used as a section criterion.

** For example, >100 on-off cycles, >16 hours of operation, >10 exposures to oxygen containing environment.

*** Electrical thrust efficiency, η_t, is defined as: $\eta_t = (FI_s g_o)/2P_e$, where F is the thrust generated by the thruster, Is is the specific impulse, go is the acceleration of gravity, and Pe is the wall-plug power input to the thruster (see for example Sutton, G.P., and Biblarz, O., Rocket Propulsion Elements, John Wiley and Sons, New York, NY, 2001, pg. 665).

**** Depending on approach, 90% efficiency may not be theoretically possible at 500 s Isp. Offerors should define the efficiency they expect to obtain, and seek to approach theoretical efficiency, to the extent possible.

MEP vs. MSP Structure

	MEP		
Metric	**Phase I**	**Phase II**	**Phase III**
Challenge	Individual thruster	Thruster system	Thruster system
Duration	12 mo.	12 mo.	12 mo.
Power	1W	100 W	1 kW
Isp Range	~2500 s, ~7000 s	2000 s - 10,000 s	500 s - 10,000 s
Efficiency	50%	> 90%	> 90%

	MSP			
Metric	**Phase I**	**Phase II**	**Phase III**	**Phase IV**
Challenge	Unit Cell		Scaling	
	Operation	Performance		
Duration	TBD*	TBD*	TBD*	TBD*
Power	25+ emitters	25+ emitters	1 W	100 W
Isp Range	Repeatable** emission < 2000 s	500s – 10,000 s		
	Repeatable** emission 500 s	(on-the-fly adjustable)		
Efficiency	10%	50%	70%	90%***

* Phase duration to be determined by bidders. Used as selection criterion.
**For example , >100 on-off cycles (100x), >16 hrs. operation (100x), >10 oxygen exposure cycles (10x). Well characterized and repeatable performance. Not all emitters need fire in Phase IIa.
***90% emission at 500 s Isp not theoretically possible. Target ~80%.